

and succeeding shorter, triangular in shape, with the apex proximal. All the side arm-plates meet their fellows below, the line of suture deep; above the insertion of the spines they appear to form a scale on the side of the arm. Upper arm-plates broader than long, very regularly oblong, though the proximal edge is encroached upon by the scale-like portions of the side arm-plates; a good deal arched near the disk.

Disk bulging a little between the arms, flat, covered with plates of various sizes, among which the five primary and the central are very distinct; a not very regular row of plates extends along the middle of each interbrachial space as far as the edge of the disk. Just below this there is one very large plate. Radial shields rather long, broader without than within, where they are pointed; separated from one another. The scales on the actinal surface diminish in size and increase in numbers from without inwards. Papillæ along edge of genital scale small, numerous, closely set; about twelve may be seen from above, of which the uppermost are smaller than those just beyond them. Arm-spines three or four, of which the uppermost is longest, and longer than an arm-joint. Three tentacle-scales as far as the sixth or seventh arm-joint; a rudimentary third may persist for some further distance; after a time the second scale disappears and only one persists.

Hab. Ecuador; from the Haslar coll. (J. O. Goodridge, Surgeon R.N.). Coloration creamy yellow, in alcohol, after perhaps thirty years' preservation.

Measurements.—Diam. of disk 19; 16 mm. Length of arms 74; 54. Breadth of arms at base 5; 3.5. Length of radial shields 4; 3.3.

EXPLANATION OF PLATE XVI.

Fig. 1. *Pectinura ramsayi*, from above, to show the general form of the body.

2. Mouth-angle of *P. ramsayi*, $\times 2$.

3. *P. capensis*, from above, $\times 2$.

4. Mouth-angle of *P. capensis*, $\times 4$.

5. Mouth-angle of *Ophiopeza assimilis*, $\times 2$.

6. Mouth-angle of *Ophioglypha amphitrites*, $\times 4$.

3. On certain Points in the Visceral Anatomy of *Balaniceps rex*, bearing upon its Affinities. By FRANK E. BEDDARD, M.A., Prosector to the Society, Lecturer on Biology at Guy's Hospital.

[Received May 9, 1888.]

I have been able lately, through the kindness of Mr. Charles Stewart, to examine the viscera of a specimen of *Balaniceps rex* preserved in the stores of the College of Surgeons. The specimen was purchased from this Society some 25 years ago; it was one of those brought back by Mr. Petherick in 1860.

So far as I am aware there has been no description of the viscera of

Balæniceps rex; the osteology, however, and some of the more important external characters (*i. e.* the presence of powder-down patches) have been described by Prof. Parker¹ and by Mr. A. D. Bartlett² in the publications of this Society. The memoirs of these two naturalists and their views as to the affinities of *Balæniceps* will be further referred to in the course of the present notes.

With regard to the viscera, I am not able to give anything like a complete account; only the alimentary tract with the kidneys and the trachea and bronchi were preserved in the College of Surgeons; an attempt had been made to inject the intestinal arterial system, but the injection had not been successful.

Alimentary Tract.

The *tongue* is short and broad, forming an approximately exact equilateral triangle; the smallness of the tongue has been already noticed by Prof. Parker³. The tongue of *Balæniceps*, in fact, agrees with that of *Scopus umbretta*⁴.

In the *liver* the right lobe is very much larger than the left; and, as in all Herodiones, there is a gall-bladder present. With regard to the proportions of the lobes of the liver there is not much to say concerning the affinities of the bird. On the whole the Storks are characterized by having an equilobed liver; the Herons (including *Scopus*) are on the whole to be distinguished from the Storks by the fact that the right lobe of the liver is larger than the left. There are, however, numerous exceptions which prevent our defining the Ardeidæ as Herodione in which the right lobe of the liver is larger than the left lobe. It is to be noted that these exceptions appear to be entirely among the Herons. In the Storks the lobes of the liver are invariably subequal, while among the Herons they are rarely so.

There is therefore, in my opinion, some reason to regard the structure of the liver in *Balæniceps* as indicating its Ardeine affinities, and there is no reason against uniting it particularly with *Scopus*.

In the *intestines* I could not discover any traces of cæca at all; I believe that the single cæcum which characterizes the Ardeidæ (there are two in the Ciconiæ) may be extremely minute, and might therefore easily escape recognition in the spirit-preserved alimentary tract⁵.

Syrinx.

The most characteristic organ of *Balæniceps* from the point of view of the affinities of the bird is unquestionably the syrinx. This

¹ See P. Z. S. 1860, p. 243; "On the Osteology of *Balæniceps rex*," Trans. Zool. Soc. vol. iv. p. 269.

² "On the Affinities of *Balæniceps*," P. Z. S. 1861, p. 131 (reprinted in Nitzsch's 'Pterylographie,' Ray Soc. edition, p. 155).

³ Abstract of Notes on the Osteology of *Balæniceps rex*. P. Z. S. 1860, p. 330 (note ii).

⁴ Beddard, "A Contribution to the Anatomy of *Scopus umbretta*," P. Z. S. 1884, p. 543.

⁵ Mr. W. A. Forbes (Collected Papers, p. 333 note) has noted a single cæcum in a specimen mounted in the Museum of the Royal College of Surgeons.

Fig. 1.

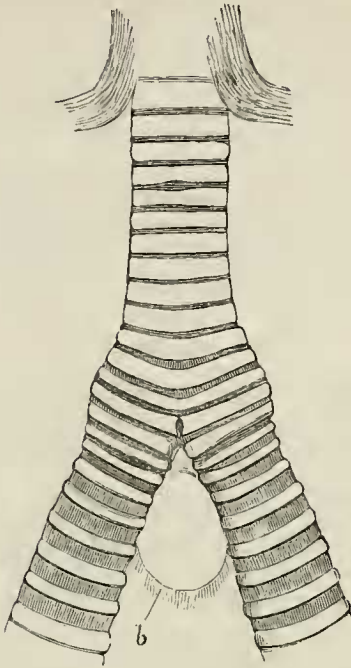
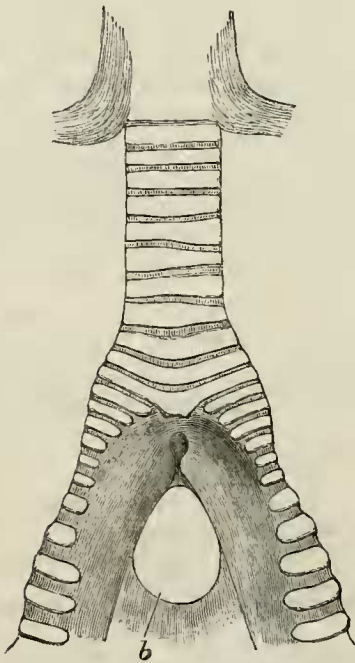
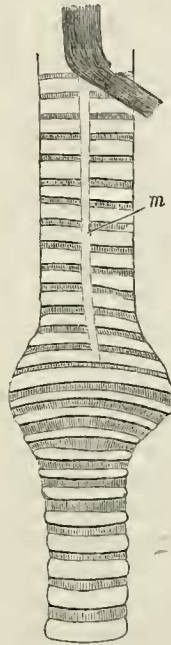
Syrinx of *Balaniceps rex*. Front view. *b*, free margin of bronchidesmus.

Fig. 2.

Syrinx of *Balaniceps rex*. Posterior surface. *b*, as in fig. 1.

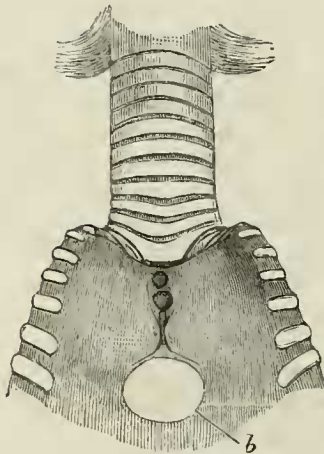
organ is represented in the accompanying drawings (woodcuts, figs. 1, 2, 3, 4), which illustrate its different aspects.

Fig. 3.



Syrinx of *Balæniceps rex*. Lateral view. *m*, ligamentous rudiment of intrinsic syringeal muscle.

Fig. 4.



Syrinx of *Balæniceps rex*. The two bronchi are bent upwards backwards to display the pessulus and membrana tympaniformis. *b*, as in fig. 1.

Before studying the syrx itself it is interesting to note that the membrane termed by Garrod the bronchidesmus, which binds together the two bronchi, is incomplete above, as shown in figs. 1, 2, 4. This

character recalls the Ardeine syrinx¹; in the Storks the bronchidesmus appears to be invariably complete—that is to say, it extends right up to the point of bifurcation of the bronchi. The syrinx itself is almost completely Ardeine; the rings are entirely cartilaginous; there appear to be no traces of ossification anywhere; there is a well-marked pessulus (fig. 4); the bronchial rings are only semirings, and there is therefore a well-developed *membrana tympaniformis externa*; the free extremities of each of the bronchial semirings begin to approach each other some little way before the entrance of the bronchi into the lungs, but they do not become whole rings. In all the characters mentioned the syrinx of *Balæniceps* is distinctively Ardeine, and as clearly unlike any Stork. The only true Stork which is at all markedly abnormal in the structure of the syrinx is *Abdimia*²; in this genus, and to a much less extent in *Xenorhynchus*, the first bronchial rings are semirings, and there is therefore a *membrana tympaniformis*; but in these two genera the lowermost rings of the trachea are modified in the typically Ciconiine fashion³.

The only point, in fact, in which the syrinx of *Balæniceps rex* is not thoroughly Ardeine is in the absence of a pair of intrinsic muscles; so far as I am aware, all the Ardeidæ, and also *Scopus*, are characterized by the presence of a single pair of muscles.

A careful examination of the syrinx of *Balæniceps*, however, does, in my opinion, show traces of a syringeal muscle. On each side of the syrinx, and rather nearer to its posterior than to its anterior border, is a delicate ligament (which is shown rather exaggerated in the drawing, fig. 3, p. 287), running from the first bronchial semiring to one of the last tracheal rings. The occasional degeneration of muscles into tendons leads me to think that this fibrous band is really a degraded rudiment of the syringeal muscles.

The facts recorded in the present paper are conclusively in favour of regarding *Balæniceps* as a Heron and not a Stork. It now remains to be seen how far they are in accord with other observations upon the structure of this remarkable bird. The important discovery by Mr. Bartlett⁴ of powder-down patches on *Balæniceps* is evidently in favour of the Ardeine as opposed to the Ciconiine affinities of the bird. The value of the evidence must of course be discounted by the very irregular distribution of powder-down patches among birds; but in the present case the evidence is of more weight, because it is associated with other characters, all of which point the same way.

A very detailed study of the osteology of the *Balæniceps* has led Prof. Parker to the opinion that "its nearest relations are the South-American Boatbill (*Cancroma cochlearia*) and the little South-African Umbre (*Scopus umbretta*)."

¹ I have figured the bronchidesmus in the syrinx of *Scopus* (P. Z. S. 1884, p. 544); in *Balæniceps* the anterior (free) margin is further away from the bifurcation of the bronchi than in *Scopus*.

² See F. E. Beddard, "On the Trachea in certain Storks," P. Z. S. 1886, p. 321.

³ Weldon, "On some points in the Anatomy of *Phanicopterus* and its allies," P. Z. S. 1883, p. 639.

⁴ *Loc. cit.*

In a postscript added to his paper Prof. Parker again dwells upon the Ardeine affinities of *Balæniceps*, quoting the discovery of powder-down patches by Mr. Bartlett.

Prof. Reinhardt¹, while admitting that *Balæniceps* comes nearer to *Cancroma* than to the Pelicans (to which group it was referred by Mr. Gould), is disposed to think that the resemblances in the beak to the former bird are merely superficial, and that as the middle claw is not pectinated *Balæniceps* cannot be referred to the Herons. Prof. Reinhardt would associate *Balæniceps* particularly with *Scopus*.

After reviewing the general structural characters of the birds in question, I cannot agree with Prof. Reinhardt's conclusion any more than could Mr. Bartlett.

Balæniceps agrees with *Scopus* in many osteological characters, through apparently not more closely than it agrees with *Cancroma* &c. The syrinx also is somewhat like that of *Scopus*, but differs in certain particulars, such as the absence of the syringeal muscles. The syrinx of *Balæniceps*, however, agrees equally with other Ardeidæ in all these particulars.

Balæniceps differs from *Scopus* in having powder-down patches, and only one cæcum to the intestine.

The differences seem to me to be more striking than the resemblances. I should regard *Balæniceps*, in fact, as a rather aberrant Heron, having no near affinities to the Storks nor to *Scopus*. The following diagram expresses the conclusion with respect to the mutual affinities of the Herodiones to which our present knowledge of the structure of the group appears to me to point :—

Fig. 4.

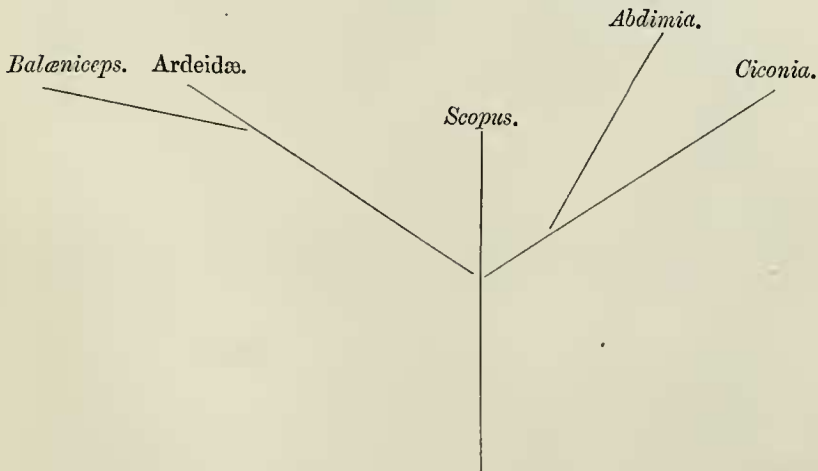


Diagram of the Herodiones.

Scopus, which combines in so many ways the structural characteristics of Herons and Storks, probably comes near to the ancestral form of both groups.

¹ "On the Affinities of *Balæniceps*," P. Z. S. 1860, p. 377.

The Ciconiine stem gave off *Abdimia* before the Ciconiine characters were fully acquired. *Balæniceps* appears to me to be a further specialization of the Ardeidæ, and not to stand nearer to the form which gave rise to the Ardeidæ. I believe this because *Balæniceps* is decidedly a Heron in respect of its alimentary tract, powder-down patches, and syrinx; the loss of the syringeal muscles is a further specialization, and evidently a recent one (from the fact of their degenerate equivalent being present). The form of the syrinx in the Herodiones was originally that which is now seen in *Scopus* and the Ardeidæ; that this is so, seems to be shown by the fact that the Ardeine form of syrinx is found in so many other groups of birds, while the Ciconiine form is peculiar to the Ciconiæ. In *Abdimia* (and to a less extent in *Xenorhynchus*) the syrinx has not quite acquired the typical Ciconiine form—the *membrana tympaniformis* is, to a considerable extent, left; that is to say, the bronchial semi-rings have not yet united to obliterate the *membrana tympaniformis*, as is the case with the typical Storks. For this reason I regard *Abdimia* as having branched off from the main stem a little before the development of the typical Storks.

4. Description of a Gigantic new Species of *Aspergillum*
from Japan. By G. B. SOWERBY, F.Z.S., F.L.S.

[Received May 3, 1888.]

ASPERGILLUM GIGANTEUM, n. sp.

Asp. testa valvis magnis, subtrapezoideis, concentricè rugosis irregulariter striatis; antice paulum attenuatis, rotundatis; postice latioribus oblique truncatis. Vagina maxima, elongata, solidiuscula, subrecta, calculos et arenulas agglutinante; limbo conspicue irregulariter 6-7-fariam foliato; disco irregulariter convexo, calculos et conchas agglutinante, tubulis numerosis parvisculis rotundatis armato.

Hab. Japonia.

A species of extraordinary magnitude, the specimen being over 13 inches ($32\frac{1}{2}$ centim.) in length and about $1\frac{1}{2}$ inches (4 centim.) in diameter, in the widest part. The sheath is of the form of *A. vaginiferum*; but the valves are much larger in proportion and of quite a different form, which, apart from the unusual dimensions, would be sufficient to constitute it a distinct species. The valves are 25 millim. long and 15 broad.

A second specimen (somewhat smaller, but in better condition) of this species is in the Museum of the Zoological Society ("Natura Artis Magistra") of Amsterdam, placed there by Mr. Oltmans, the late Curator, with the name of *Aspergillum japonicum*, confirming the locality. So far as is at present known, *Aspergillum vaginiferum* inhabits exclusively the Red Sea.